

CLAIMS

We claim:

5 1. A microfluidic device including a channel therethrough having upstream and downstream ends and being adapted for receiving a vesicle, the vesicle containing predetermined cargo therein and having an outer surface carrying a bioactive molecule, the microfluidic device comprising:

 a suspension structure positioned within the channel for retaining the vesicle at a
10 selected location within the channel; and

 a detection structure positioned in the channel downstream of the suspension structure, the detection structure providing a reaction in response to exposure to the cargo.

15 2. The microfluidic device of claim 1 wherein the detection structure includes a first post that dissolves in response to exposure to the cargo.

 3. The microfluidic device of claim 2 wherein the detection structure display includes a second post that is non-responsive to exposure to the cargo.

20 4. The microfluidic device of claim 2 wherein the first post is formed from polyacrylamide and dissolvable disulfide crosslinkers.

 5. The microfluidic device of claim 1 further comprising a reagent receivable
25 in the channel, the reagent flowable from the upstream end to the downstream end of the channel.

 6. The microfluidic device of claim 1 wherein the reagent includes
30 predetermined stimuli therein, the predetermined stimuli reacting with the bioactive molecule to free the cargo from the vesicle.

7. The microfluidic device of claim 1 wherein the suspension structure includes a filter having a predetermined pore size, the pore size being of a dimension that prevents the vesicle from flowing downstream of the filter and that allows the cargo to flow downstream through the filter.

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8. A method of relaying and amplifying an initial biochemical signal in a microfluidic device, comprising the steps of:

encapsulating cargo within a vesicle, the vesicle having an outer surface;

5 implanting a bioactive molecule in the outer surface of the vesicle;

exposing the vesicle to a reagent;

releasing the cargo from the vesicle in response to predetermined stimuli in the reagent; and

generating a reaction display in response to the release of the cargo.

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9. The method of claim 8 comprising the additional step of providing a microfluidic device having a channel therein and wherein the step of exposing the vesicle to the reagent occurs in the channel of the microfluidic device.

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10. The method of claim 8 comprising the additional step of passing the cargo through a filter.

11. The method of claim 10 comprising the additional step of positioning the filter in the channel for capturing the vesicle upstream thereof.

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12. The method of claim 11 wherein the step of generating a reaction includes the step of positioning a visual display in the channel downstream of the filter.

13. The method of claim 12 wherein the visual display includes a responsive post that dissolves in response to exposure to the cargo.

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14. The method of claim 13 wherein the step of generating a reaction includes the additional step of dissolving the responsive post.

15. The method of claim 13 wherein the visual display includes a non-responsive post having a configuration, the configuration of the non-responsive post maintained in response to exposure to the cargo.

5 16. The method of claim 8 wherein the vesicle is a liposome.

17. The method of claim 8 wherein the bioactive molecule is an antigen.

18. The method of claim 8 wherein the predetermined stimuli include an
10 antibody and a set of proteins.

19. A method of relaying and amplifying an initial biochemical signal in a microfluidic device, comprising the steps of:

positioning a vesicle in the upstream end of the channel, the vesicle containing predetermined cargo therein and having an outer surface carrying a bioactive molecule;

5 exposing the vesicle to a reagent;

releasing the cargo from the vesicle in response to predetermined stimuli in the reagent binding to the bioactive molecule; and

generating a reaction in the channel downstream of the vesicle in response to the release of the cargo.

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20. The method of claim 19 comprising the additional step of positioning a filter in the channel for capturing the vesicle upstream thereof.

21. The method of claim 20 wherein the step of generating a reaction includes
15 the additional step of positioning a visual display in the channel downstream of the filter.

22. The method of claim 21 wherein the visual display includes a responsive post that dissolves in response to exposure to the cargo.

20 23. The method of claim 22 wherein the step of generating a reaction includes the additional step of dissolving the responsive post.

24. The method of claim 23 wherein the visual display includes a non-responsive post having a configuration, the configuration of the non-responsive post
25 maintained in response to exposure to the cargo.

25. The method of claim 19 wherein the vesicle is a liposome.

26. The method of claim 19 wherein the bioactive molecule is an antigen.

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27. The method of claim 19 wherein the predetermined stimuli include an antibody and a set of proteins.